REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY *(Leave blank)*	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED

4. TITLE AND SUBTITLE
Working in the Zone: Maintaining Optimal Readiness in U. S. Soldiers

5. FUNDING NUMBERS

6. AUTHOR(S)
Castro, C. A., Huffman, A. H., Dolan, C. A., Bienvenu, R. V., & Adler, A. B.

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Commander
Attn: Medical Research Unit
CMR 442
APO AE 09042

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)
US Army Medical Research & Material Command
Ft. Detrick, Frederick, MD 21702-5012

10. SPONSORING / MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION / AVAILABILITY STATEMENT
Approved for public release; distribution unlimited.

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*

Soldier readiness is associated with the pace of military operations. For example, in a study of soldiers deployed to Bosnia-Herzegovina, as deployed length increased well being declined. Building on this finding, we hypothesized that there is an ideal zone of operational tempo that maximizes readiness (e.g. performance) for units and soldiers. In order to identify this zone or band of performance, we have begun a two year study of 10 U. S. Army companies stationed in Europe, representing combat and support units. Pace of operations was viewed as mulitdimensional and included several measures such as deployment length, work hours, days on training exercises, sleep, and number of workdays per week. Data were gathered using surveys, interviews, and unit records and included issues related to medical readiness, military readiness, and family readiness. Assessment occurred in three environmental contexts: while the soldiers were in garrison, on training, or on deployment to Kosovo or Saudi Arabia. Initial findings revealed that operational tempo measures such as work hours, working on days off, losing leave time, and predictability were important in determining a band of optimal soldier performance. The environmental context, however, was critical in understanding these relationships. for instance, while both training and deployed environments produced and increase in work hours, soldiers assessed in the training environment reported increased military readiness, whereas deployed soldiers reported a decrease in military readiness. This emerging model highlights the complexity of identifying a set of predictors for maintaining soldiers and units in an optimal zone of readiness.

14. SUBJECT TERMS
Deployment length, work hours, days on training exercises, sleep .

15. NUMBER OF PAGES

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
UNCLAS	UNCLAS	UNCLAS	

Working in the Zone:
Maintaining Optimal Readiness in U.S. Soldiers

Castro, C.A., Huffman, A. H., Dolan, C.A., Bienvenu, R.V. and Adler, A. B.

U.S. Army Medical Research Unit-Europe
Walter Reed Army Institute of Research
Heidelberg, Germany

Mailing Address: The U.S. Army Medical Research Unit-Europe, Nachrichten Kaserne, Karlsruher Str. 144, 69126 Heidelberg, GE.

Email address: castro.carl@hbg.amedd.army.mil

Phone number: 49-6221-17-2626

TITLE: Working in the Zone: Maintaining Optimal Readiness in U.S. Soldiers

AUTHORS: Major Carl A. Castro, Ann H. Huffman, Dr. Carol Dolan, Captain Robert V. Bienvenu, and Dr. Amy B. Adler. The U.S. Army Medical Research Unit-Europe, Nachrichten Kaserne, Karlsruher Str. 144, 69126 Heidelberg, GE.

ABSTRACT: Soldier readiness is associated with the pace of military operations. For example, in a study of soldiers deployed to Bosnia-Herzegovina, as deployment length increased well being declined. Building on this finding, we hypothesized that there is an ideal zone of operational tempo that maximizes readiness (e.g., performance) for units and soldiers. In order to identify this zone or band of performance, we have begun a two-year study of 10 U.S. Army companies stationed in Europe, representing combat and support units. Pace of operations was viewed as multidimensional and included several measures such as deployment length, work hours, days on training exercises, sleep, and number of workdays per week. Data were gathered using surveys, interviews, and unit records and included issues related to medical readiness, military readiness, and family readiness. Assessments occurred in three environmental contexts: while the soldiers were in garrison, on training exercises, or on deployment to Kosovo or Saudi Arabia. Initial findings revealed that operational tempo measures such as work hours, working on days off, losing leave time, and predictability were important in determining a band of optimal soldier performance. The environmental context, however, was critical in understanding these relationships. For instance, while both training and deployed environments produced an increase in work hours, soldiers assessed in the training environment reported increased military readiness, whereas deployed soldiers reported a decrease in military readiness. This emerging model highlights the complexity of identifying a set of predictors for maintaining soldiers and units in an optimal zone of readiness.

The operations tempo (OPTEMPO) readiness model predicts that the pace of military operations affects soldier and unit performance (Castro & Adler, 1997, 1999). The nature of these affects, however, may be non-linear when the pace of operations are examined at both of the extremes (see Figure 1). When the pace of operations are either very low or very high, soldier and unit performance suffers. For instance, if soldiers or units never or seldom conduct training, then overall readiness will decline. Conversely, if soldiers or units are required to work extremely long hours, without time off for recovery, then fatigue may occur, thereby affecting performance.

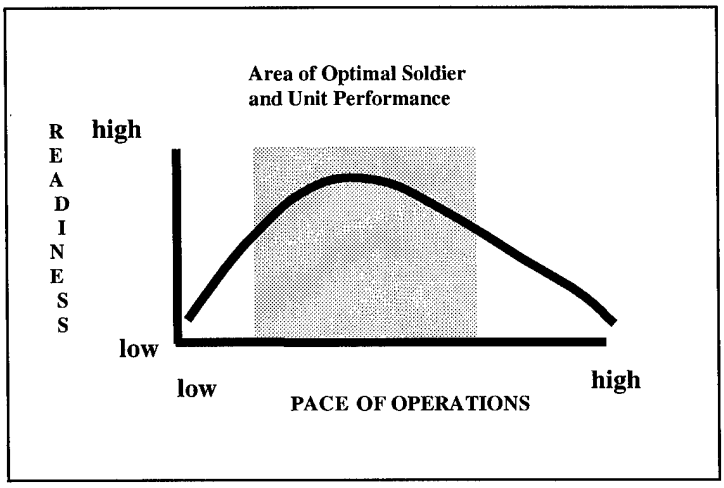


Figure 1. OPTEMPO Readiness Model

There are several additional key features about the OPTEMPO Readiness Model that merit comment. First, the area of optimal soldier and unit performance, in general, is relatively wide. That is, soldiers and units maintain a relatively high level of performance across a broad range of OPTEMPO levels. Thus, from a practical

perspective, provided that units and soldiers are properly supported, it should be relatively easy to maintain high levels of readiness.

Second, the initial slope of the readiness curve is relatively steep and short, indicating that as the pace of military operations increases there is an immediate gain in soldier and unit readiness. For instance, a single training exercise that is well planned and executed can immediately move a unit from the low-end on the readiness curve to a point on the readiness curve that is well within the optimal zone of unit and soldier readiness.

Third, at the peak of the readiness curve, the downward slope of the curve is gradual and longer than the initial increase in the readiness curve. It should be noted that a significant portion of this decline of the readiness curve is within the band or zone of optimal soldier and unit readiness. Thus, a decline in readiness along the readiness curve does not necessarily mean that soldier or unit readiness is significantly reduced. Instead, one should only be concerned when readiness levels move outside the zone of optimal performance.

Finally, and perhaps most importantly, movement can occur in both directions along the readiness curve. As the pace of operations increases, and units and soldiers are not given an opportunity to recover, readiness levels will ultimately move outside the optimal zone of readiness and result in a decline in unit and soldier readiness. Conversely, if soldiers and units are given an opportunity to adequately recover from high periods of operations tempo then they will move towards the low end of the readiness curve, thereby remaining in the optimal zone of soldier and unit readiness.

In order to begin to understand the impact of OPTEMPO on soldier and unit readiness, soldiers and units must be studied in their key work environments. These environments include garrison, deployments, and training (see Figure 2). All three of these environments together define OPTEMPO. Further, it is also important to assess soldier and units as they are transition from one phase to another. Assessing these transitions from one phase to another is particularly important for peace support operations when units often move through all three phases, garrison to training to deployment. This pre-deployment garrison phase is perhaps the most intense OPTEMPO period for units preparing to deploy on peace support operations.

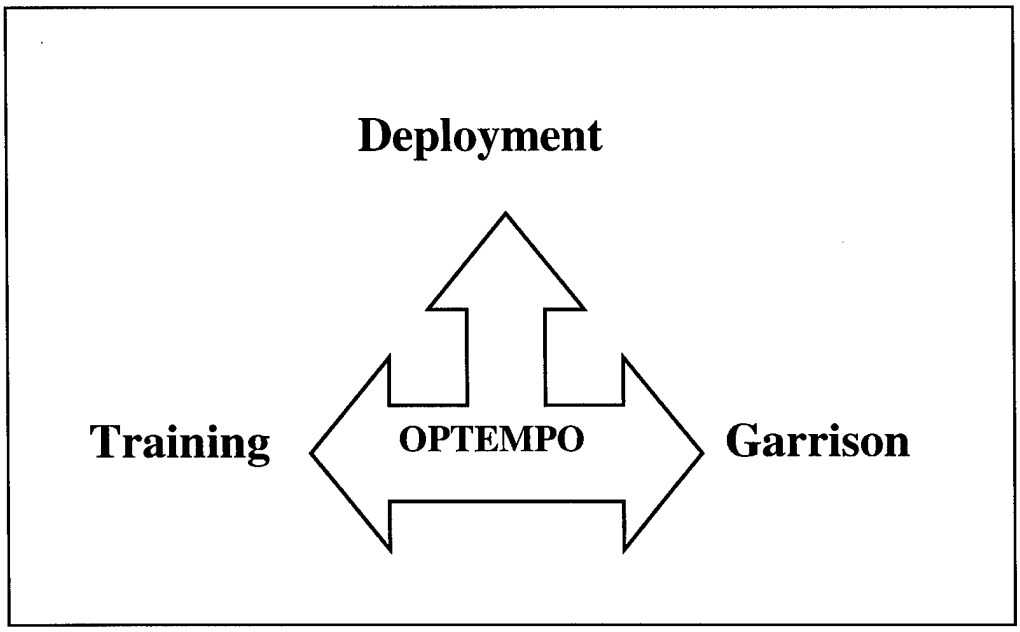


Figure 2. Key environments encountered by soldiers and units.

Castro and Adler (p. 87, 1999) defined operations tempo (OPTEMPO) as "the rate of military actions or missions." Thus, OPTEMPO pertains to both individual soldiers and units in all three of the key environments discussed above. In the present paper we define soldier readiness as "the state of being prepared mentally or physically for some experience or action."

An examplar of the utility of the OPTEMPO readiness model is shown in Figure 3. The soldiers in this sample were from the U.S. Army and were stationed in Europe. This sample comprises a subset of soldiers from a larger research program that we are executing in the U.S. Army, Europe to fully examine the impact of OPTEMPO on soldiers, leaders, units, and families. In this garrison example, the measure of OPTEMPO was the number of hours that soldiers reported working during the past week. The readiness indicator selected was the number of alcoholic drinks that soldiers reported having over the past week. In this example, the consumption of large quantities of alcohol was viewed as a decrement to soldier readiness.

As can be seen in Figure 3, and as predicted by the OPTEMPO Readiness Model, when the pace of operations was either very high or very low, the threat to readiness increased. Specifically, when soldiers reported working 7 hours or less or more than 14 hours a day, alcohol consumption significantly increased. In contrast, when work hours ranged from 8 to 13 hours per day, alcohol consumption was relatively stable, with an average of 13-14 alcoholic drinks per week. Thus, in this case, using number of alcoholic drinks consumed per week as the readiness measure (i.e. outcome), we defined the optimal area of soldier and unit performance as including a garrison work schedule that is 8-13 hours per day.

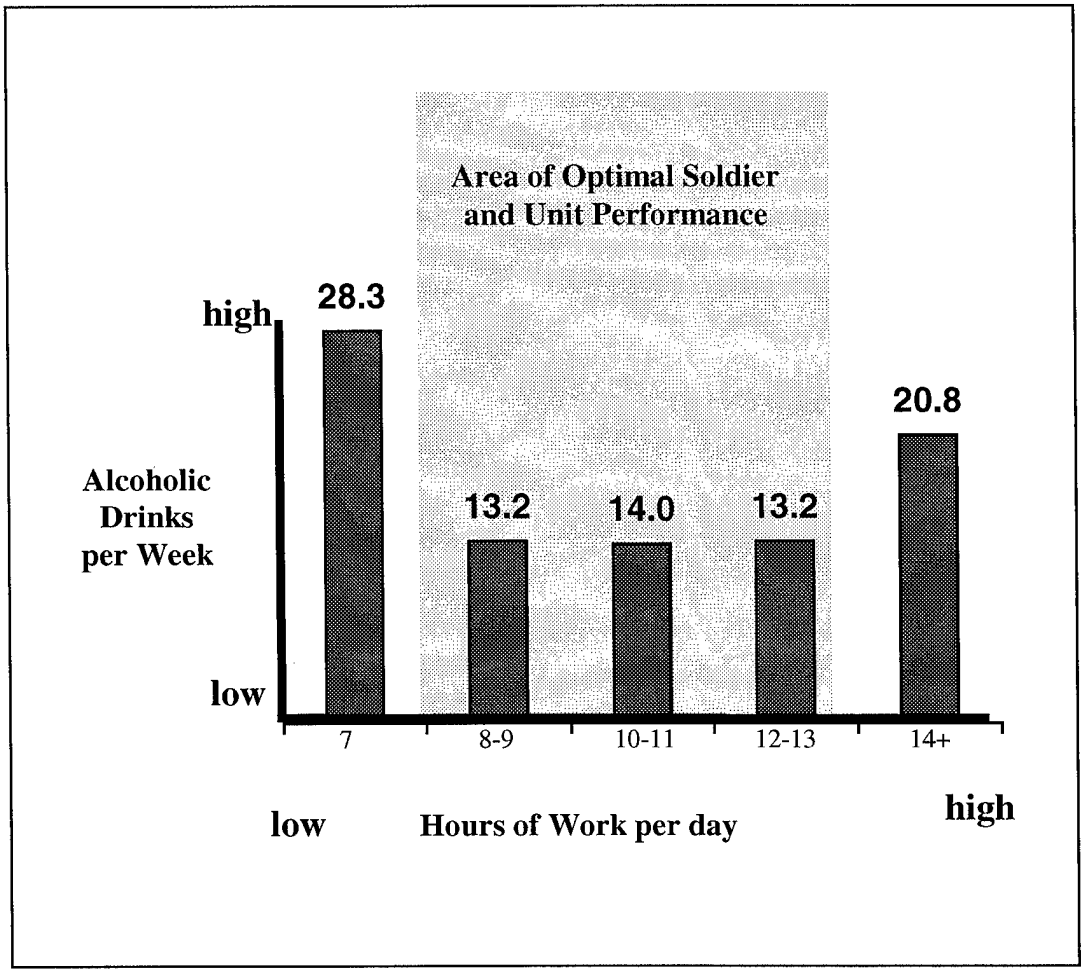


Figure 3. An examplar of the OPTEMPO Readiness Model showing how alcohol consumption and work hours affect optimal soldier and unit readiness.

How military deployments, training events, and garrison activity affect soldier and unit readiness is, of course, very complex. The shape of the readiness curve will depend on a number of important factors: the readiness indicator, the OPTEMPO measure, and the sensitivity of the measuring instruments, to name but a few. And while the OPTEMPO Readiness Model may not capture all of the areas of interest and concern, we do believe that it offers a useful starting point for determining the critical dimensions

that are important for ensuring the combat readiness of units, leaders, soldiers, and families.

References

Castro, C. A. & Adler, A. B. (1997). Operational tempo of forward-deployed soldiers in Europe. *Proceedings of the 34th International Applied Military Psychology Symposium*, Paris.

Castro, C. A. & Adler, A. B. (1999). OPTEMPO: Effects on soldier and unit readiness. *Parameters*, Autumn, 86-95.

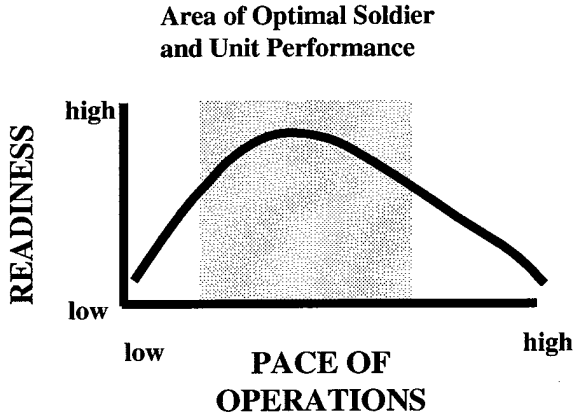
Working in the Zone:

Maintaining Optimal Readiness in U.S. Soldiers

36th International Applied Military Psychology Symposium
Split, Croatia, 11-15 September, 2000

U.S. Army Medical Research Unit-Europe, Walter Reed Army Institute of Research,
U.S. Army Medical Research and Materiel Command

OPTEMPO Readiness Model

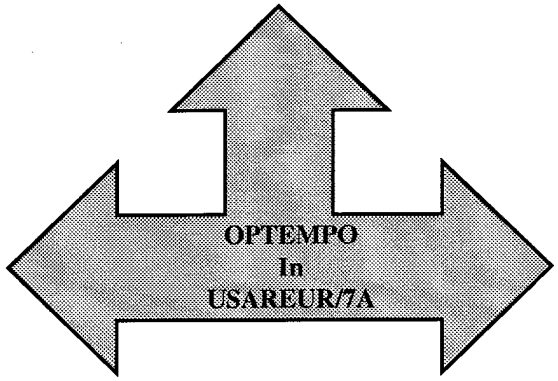


- The model predicts that pace of operations affect optimal soldier and unit performance. When the pace is either very high or very low soldier and unit readiness decline.

- The model consists of three major components: military deployments, training exercises, and garrison duties.

Deployments
- Peacekeeping
- Humanitarian
- Combat

Training
- Exercises
- Field exercises
- Schools
- Temporary Duty (TDY)



Garrison
- Rear detachment
- Garrison support

Research Design

Units - Assessment involves 10 companies, both divisional and non-divisional units. There were two units each from:

- 1st AD
- 1st ID
- V Corps
- 21st Theater Support Command
- Southern European Task Force

Longitudinal - The same 10 companies are followed over a 2-year period (JUN 1999-JUN 2001). The goal is to assess each company in garrison, during training, and during deployment.

Data Sources: Three types of data are collected quarterly (N=686 to 768)

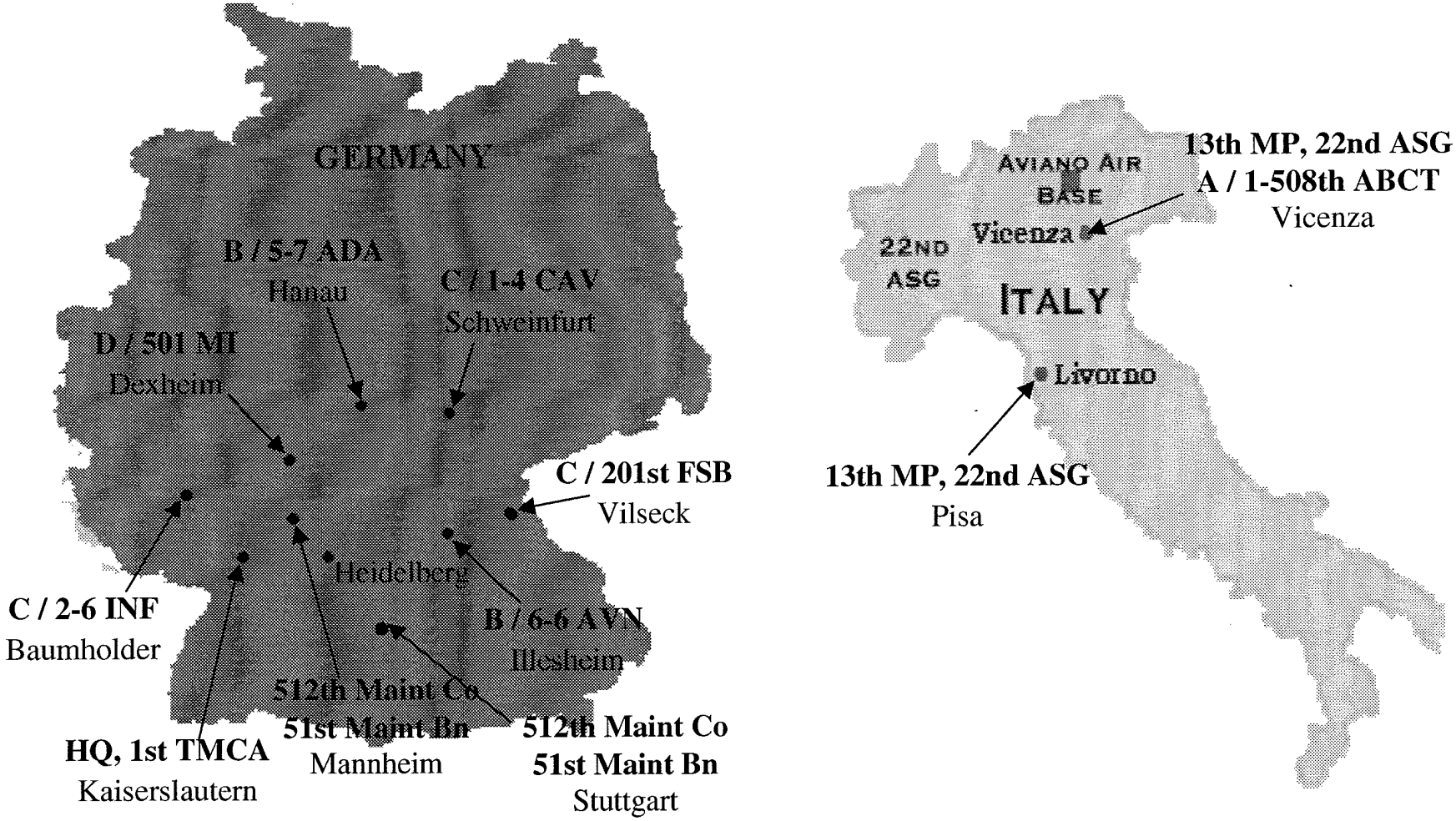
Surveys – Designed for all three environments

Interviews – Focus groups, leaders, and career intentions

Unit Outcome Measures – Data already collected by units

Unit Locations

- The 10 units in this study are located throughout the US Army, Europe.



Categories of Measures

MILITARY READINESS

- Morale
- Soldier Pride
- Combat Readiness
- Operational Readiness
- Mission Readiness
- Unit Cohesion
- Leadership (Vertical Cohesion)
- General Leadership Quality
- ✓ Awards
- ✓ Promotions
- ✓ Driving Offenses
- ✓ Safety Performance
- ✓ Gunnery Scores
- ✓ Range Scores
- ✓ UCMJ
- ✓ AWOLS

TEMPO MEASURES

- ◆ Number of Deployments
- ◆ Days on Leave/Pass
- ◆ Days on TDY
- ◆ Work Hours
- ◆ Days in Field

MEDICAL READINESS

Wellness Behaviors
- Cigarettes
- Alcohol
- Caffeine
- Sleep
- Physical Exercise
- ✓ Urinalysis
- ✓ Accidents

Well-Being
- Well-Being
- Depression
- Physical Symptoms
- ✓ APFT Scores
- ✓ Profiles
- ✓ Sick Call Rates
- ✓ Suicides

JOB ATTITUDES

- Recognition
- Challenge
- Time Commitment
- Work Intensity
- Goal Acceptance
- Job Control
- Involvement/ Engagement
- Job Satisfaction
- Work Overload
- Task Significance

SOLDIER & FAMILY ISSUES

Career Issues
- Career Decision
- Promotional Opportunity
- Re-enlist Bonus
- ✓ Retention Statistics
- ✓ Indebtedness

Family Issues
- Work/Family Conflict
- Family/Work Conflict
- ✓Family Abuse

NOTE: ✓ indicates unit objective measure.

Operations Tempo: Environment Overview

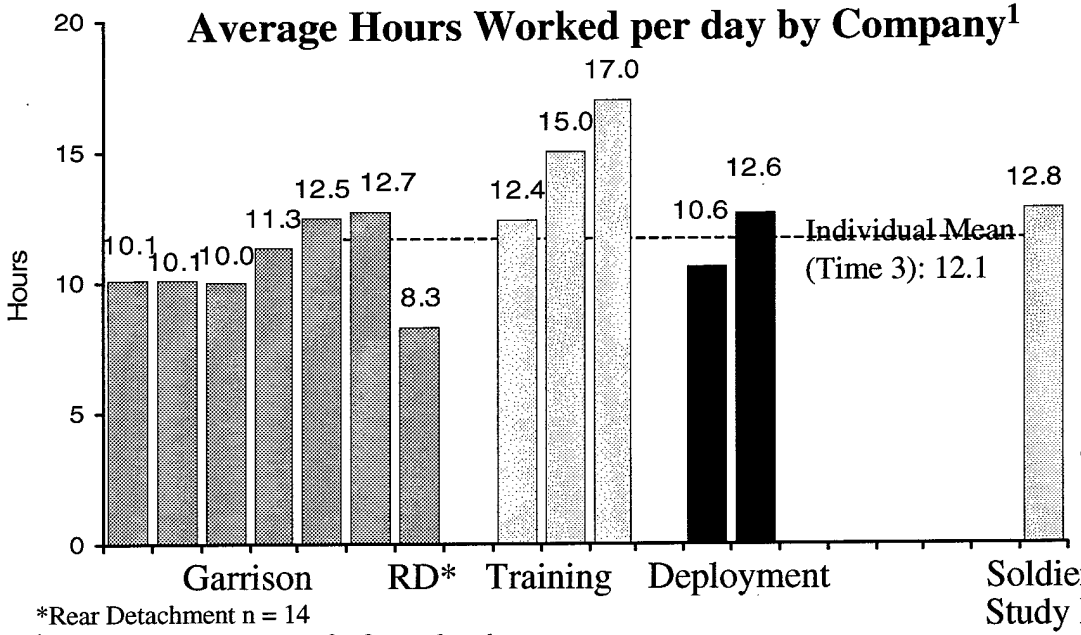
Rank	
Jr. Enlisted:	54.0%
NCO:	36.7%
Officer:	9.4%

Gender	
Female:	14.7%
Male:	85.3%

- There was a wide range in the reported levels of OPTEMPO measures (e.g. hours worked per day) across units and environments.
- For example, units reported working from 7.6 to 17.0 hours a day with an average of 12.1 hours a day.

"There is no 'after work' here." *Enlisted group interview, garrison*

Best aspects of current activity level: "I'm never bored." *Leader, garrison*



The average hours worked per day in Kosovo[2] was 12.8 hours.

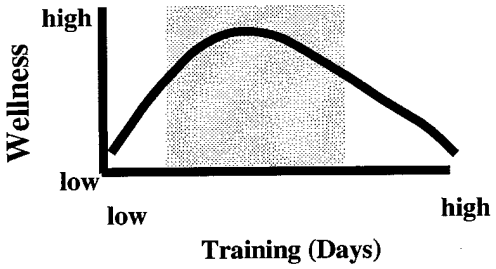
*Rear Detachment n = 14

[1]Graph includes responses for 2 rear detachments.

[2]Soldier Study II (Mar – Apr 99); Kosovo Mid-Deployment, N = 1718

Source: IPR 3

Medical Readiness: Wellness Behaviors



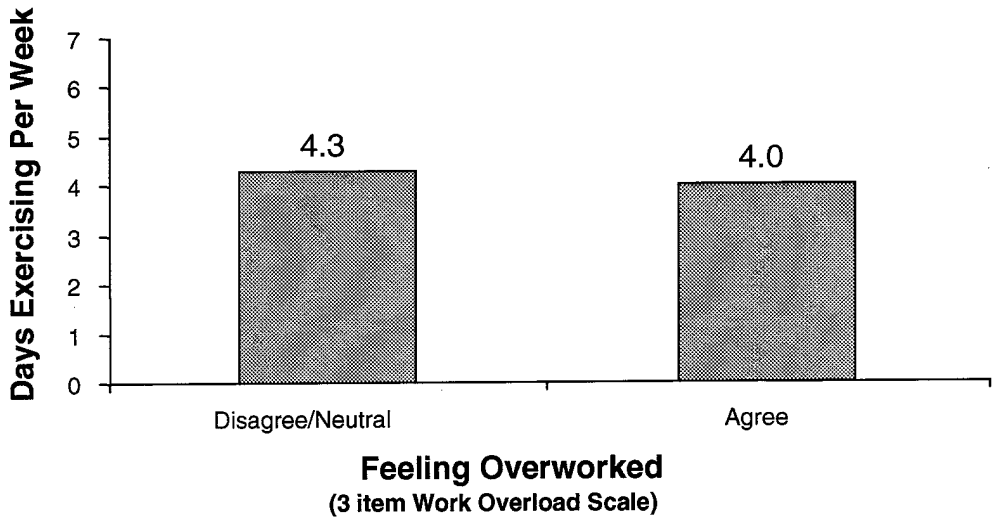
- For every 4 hours junior enlisted soldiers (E1-E4) report working on their days off, there is an associated increase of one alcoholic drink *(R Square =.01, p<.05).* There was no such relationship for NCOs and Officers.
- The more soldiers perceive work overload, the fewer days they exercise per week *(r=-.16, p<.001).*

Percent who exercised : 82.6%

Rank Differences:
None

Used Nicotine in Past Week: 48.8%

Rank Differences:*
Soldiers 54.8%
NCOs 44.3%
Officers 23.8%

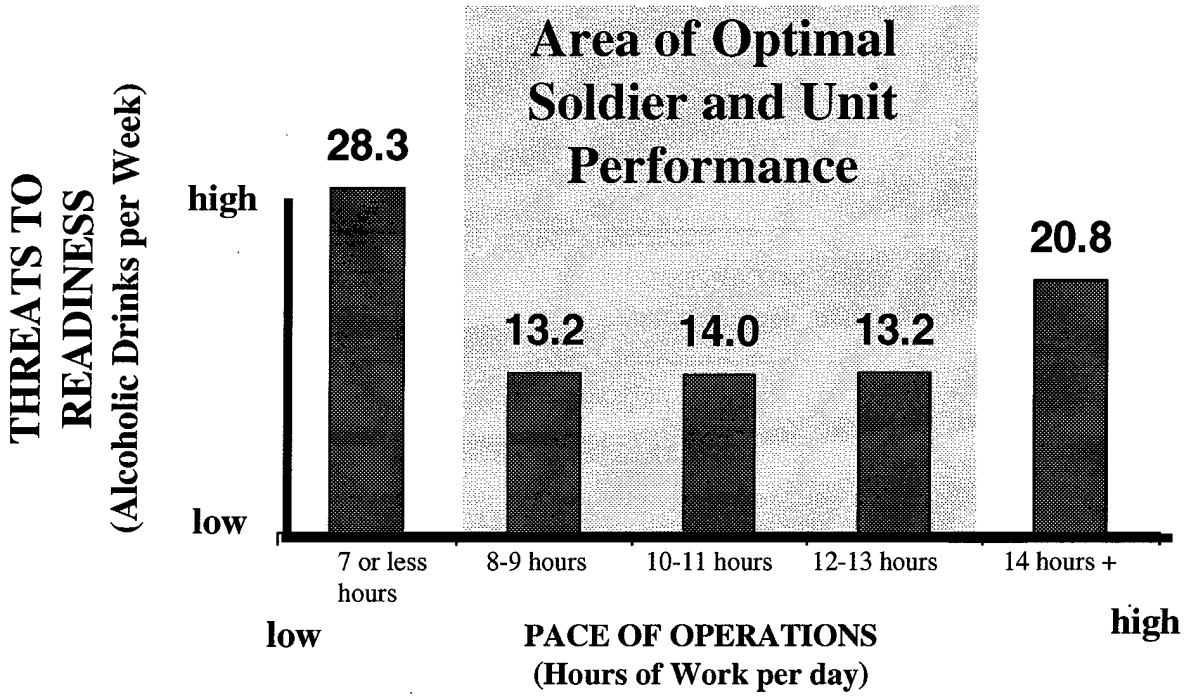


*p < .05

Source: IPR 2

Medical Readiness: Alcohol Consumption

- Pace of operations (e.g., hours of work per day) was associated with single junior-enlisted soldiers' alcohol use.[1]
- When work hours are either very high or very low threats to unit and soldier readiness increase.



Drinking is a very common escape mechanism. In the barracks, they can't be yanked into "hey you" duty if they're drunk. "I'll work hard for you on your time, but I don't want to work on my time." *Enlisted, garrison*

[1]Only single junior-enlisted soldiers who reported that they drank alcohol were included (n=148).

Source: IPR 2

Medical Readiness: Psychological Wellbeing

- The fewer hours soldiers reported sleeping, the higher their depression scores
  (R Square = .054, p<.001).

Average Number of Hours of Sleep in Past Week

5.6

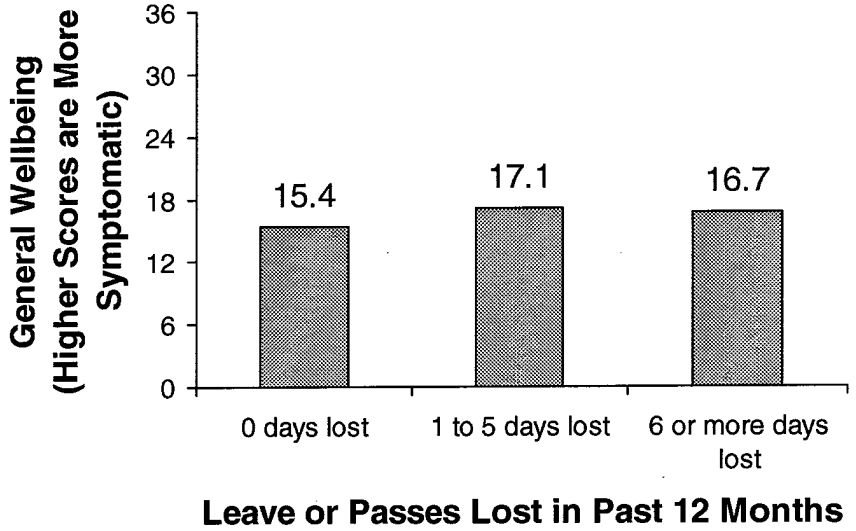
Rank Differences: None

Number of days of leave /passes lost in the past 12 months

1.4

A higher proportion of Officers reported losing leave/pass days than did NCOs and Junior Enlisted Soldiers.

- The more leave and pass days soldiers reported losing, the higher their depression scores.
- The number of leave and pass days taken did not relate to depression scores.
- Lost or cancelled leave/pass predicted lower general wellbeing.*

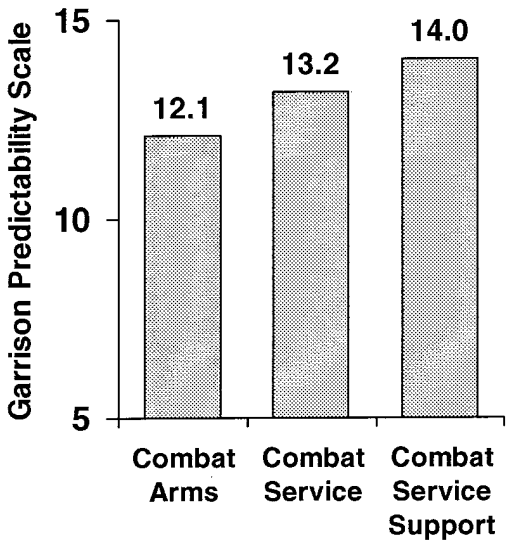


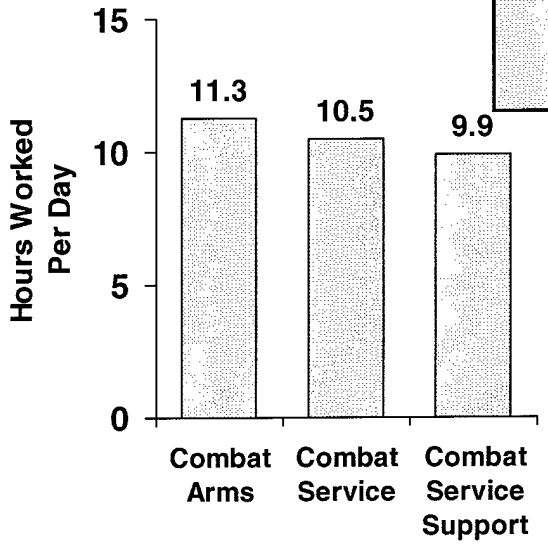
*F(2, 761)=5.34, p<.01.

Source: IPR 1

Garrison Issues: Predictability

- The majority of soldiers reported having an unpredictable work environment.[1] For example:
  - 75.7% did not agree that they had a predictable daily work schedule.
  - 66.6% did not agree that they can count on being able to take requested leave time.
  - 69.3% did not agree that they know what duty they will be doing day to day.





NCOs were more likely than junior- enlisted soldiers and officers to report predictable schedules in Garrison

Career Intention

Differences across Unit Type for Junior Enlisted Only.

Percent intending to leave

Combat Arms: 43.8%
Combat Support: 27.8%
Combat Service Support: 28.4%

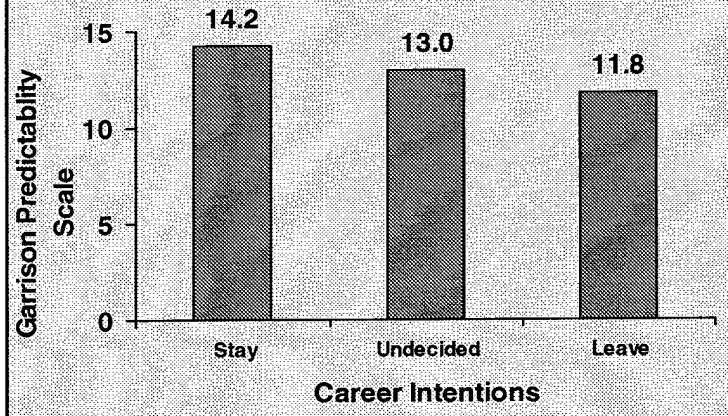
[1]Reported "strongly disagree, disagree or neutral"

Source: IPR 2

Garrison Issues: Retention

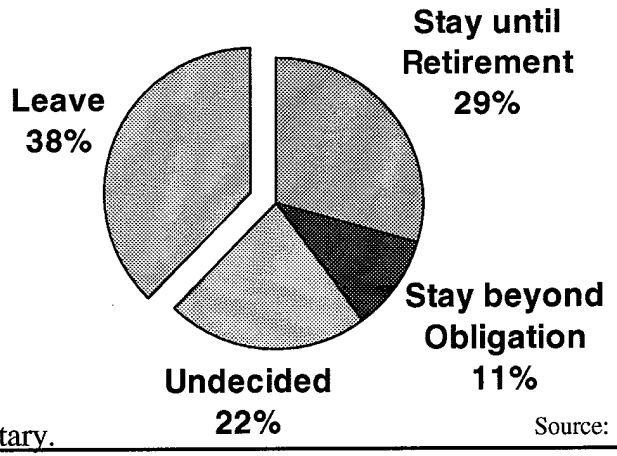
- Overall, OPTEMPO measures did not influence career intentions.[1]
- Soldiers (E1-E4, E5-E6) planning to remain in the military reported more predictability, better communication, and better training in garrison than those undecided or intending to leave the military.

Soldiers who perceive that their schedules are more predictable, were more likely to stay in the Army.



F(2,661)=20.65, p<.001.

- Officers intending to remain in the military reported more satisfaction with training in garrison than those undecided or intending to leave the military.



Source: IPR 2

[1]NCOs who work more days per week are more likely to STAY in the military.

OPTEMPO: Family[1] Issues

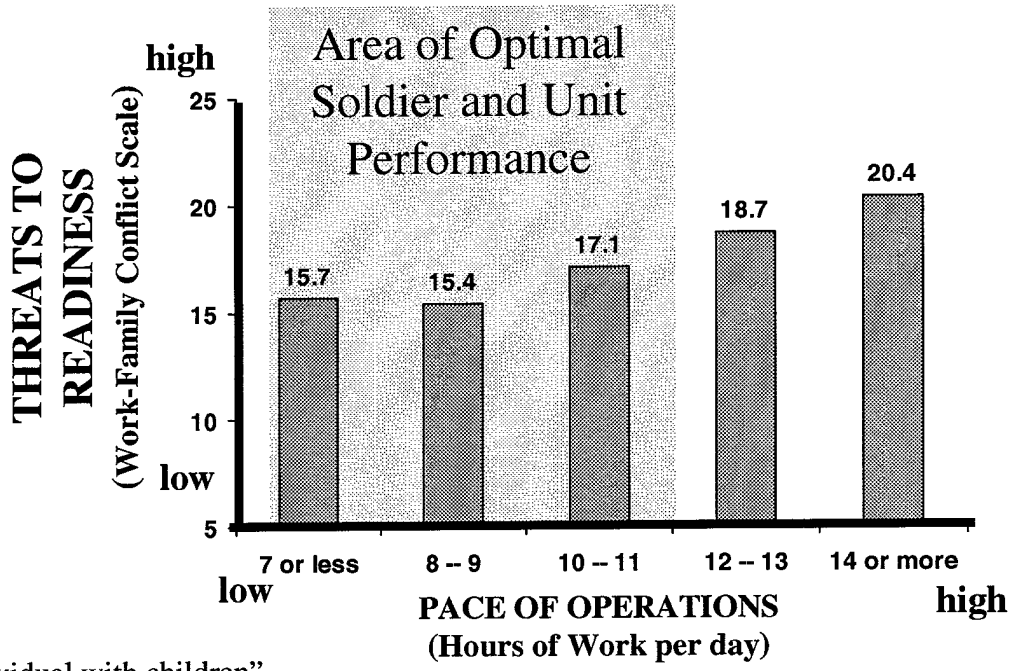
Overall, soldiers who reported high Work-Family Conflict also reported:

- ★ More lost or cancelled leave
- ★ More hours worked on days off
- ★ More days worked per week
- ★ More days on training exercises
- ★ Fewer days Temporary Duty (TDY)

Marital Status[2]

Single:	40.5%
Married:	49.9%
Divorced/Separated:	9.1%

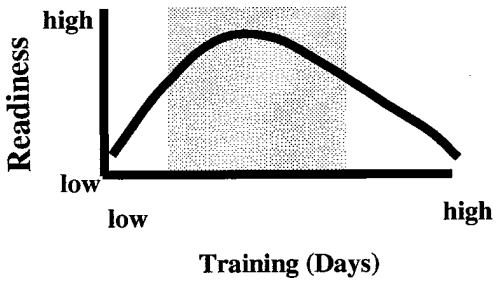
- The more hours junior-enlisted soldiers with families worked per day, the higher their Work-Family Conflict scores.



[1]Family is defined as "a married couple and/or an individual with children".
[2]Numbers may not add up to 100% because of additional categories (e.g., widowed).
*Work/Family Conflict Scale has a range of 5 to 25 with a higher score indicating more conflict.

Source: IPR 1

Training: Combat & Operational Readiness

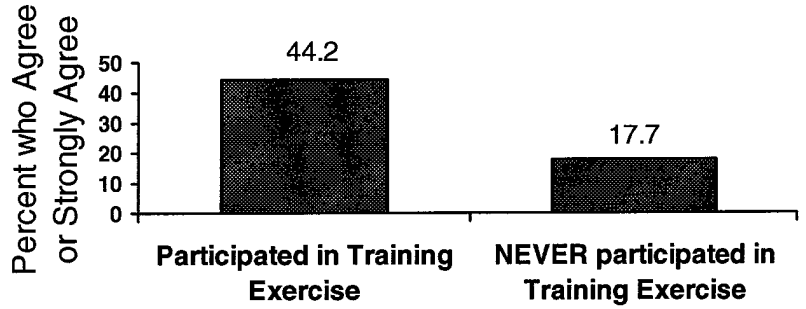


- Soldiers who have been on at least one training mission in the past six months reported more combat readiness *(7.96 v 8.71, t(159)=2.79, p<.01)* and operational readiness *(10.77 v 12.59, t(759)=4.96, p<.01)* when compared to soldiers who had not been on any training missions.

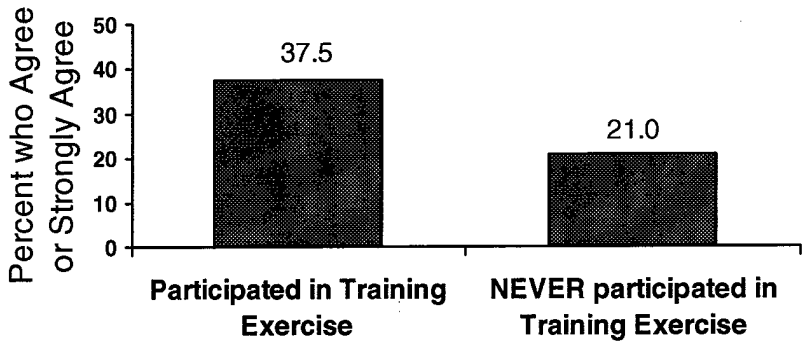
Participated in a Training Exercise:	**83.6%**
Average Number of Days Training[1]:	**36.4**

- For example, soldiers who have training experience stated that their level of training is high and their company is ready for combat.

"I think the level of training in this company is high"*



"My company is ready for combat"*

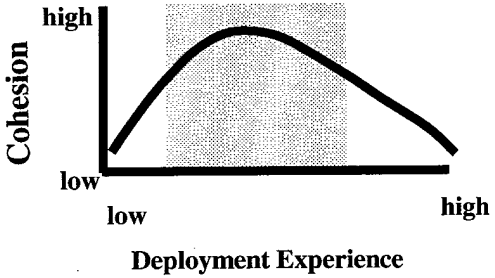


* $p < 0.001$

[1]Of those who participated on at least one training exercise.

Source: IPR 2

Deployment: Morale and Cohesion

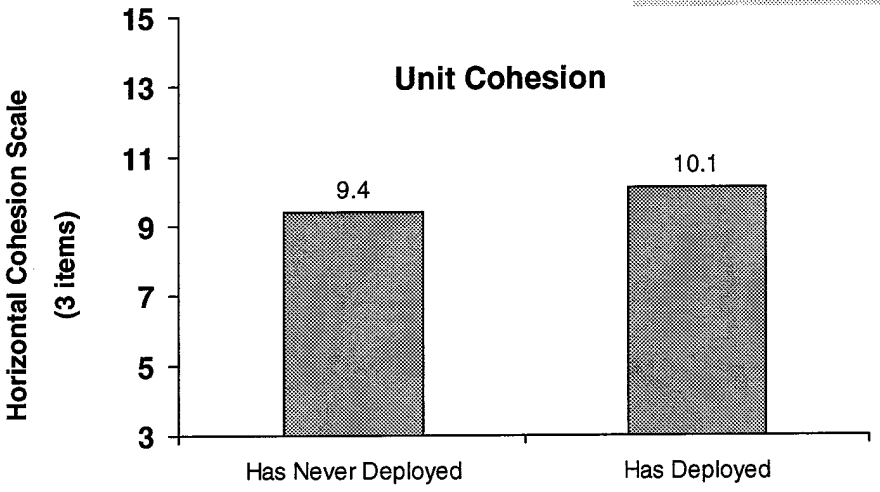


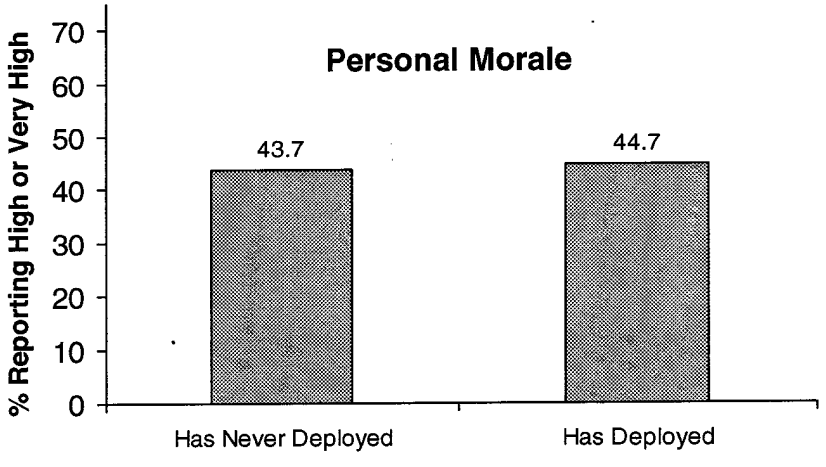
- Soldiers with deployment experience had significantly higher unit cohesion ratings than those without deployment experience *($t(756) = 3.17$, $p < .01$).*
- Deployment experience did not affect levels of personal morale.

High Personal Morale by Rank

E1 - E4: 39.6%
E5 - E6: 45.5%
E7 - E9: 75.7%
Officers: 56.0%

"A little bit of hard work is good, but when it is continuous then that takes a toll on morale. I can say with all of the soldiers that I work with, officers and soldiers alike, the morale is below average." *Leader interview, garrison*

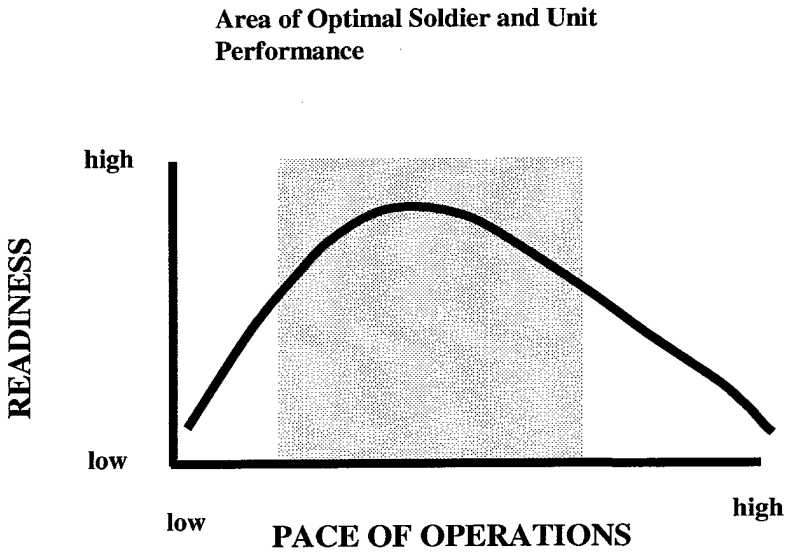


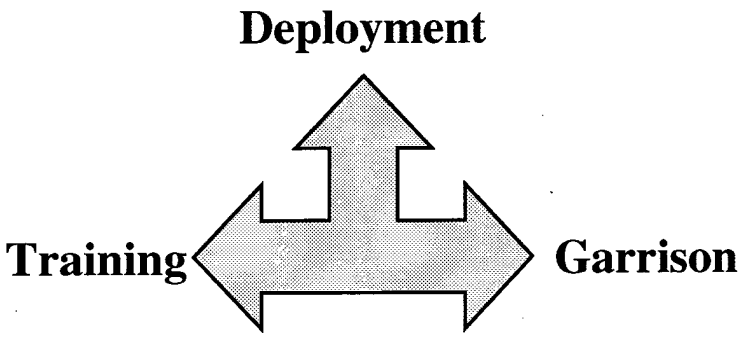


Source: IPR 2 & 3

OPTEMPO Readiness Findings

- Results from the first year of the OPTEMPO study provides support for the OPTEMPO Readiness Model.





- All three environmental contexts, garrison, training, and deployment, are important for assessing soldier and unit readiness.

The USAMRU-E Team (June 2000)